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I.G. FARBENINDUSTRIE A.G. PLANT HOECHST/MAIN, 10 & 11 April 1945

War Dept, Combined Intelligence Objectives Subcomm. Report #15

Date: 25 April 1945

COMBINED INTELLIGENCE OBJECTIVES
SUB-COMMITTEE

CONFIDENTIAL

REPORT ON VISIT TO I.G. FARBENINDUSTRIE A. G. PLANT AT HOECHST/MAIN.

10 & 11 April, 1945

Reported by

P.J. LEAPER
CWS, Hq.ETOUSA

25 April, 1945

CIOS Black List Item - 22
Miscellaneous Chemicals

COMBINED INTELLIGENCE OBJECTIVES
SUB-COMMITTEE
G-2 DIVISION, SHAEF (Rear), APO 413

CONFIDENTIAL

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PERSONNEL OF INSPECTION TEAM

Lt.Col.Joseph E. Smodel.....Medical Corps, Hq.ETOUSA
Major Francis T. Chinard....Medical Corps, Hq.ETOUSA
Major H.M. Horack.....Medical Corps, Hq.ETOUSA
Mr. Ernest V. Volwiler.....CWS, Hq.ETOUSA
Mr. Percy J. Leaper.....CWS, Hq.ETOUSA
Mr. Lester M. White.....CWS, Hq.ETOUSA

REPORT COVERING VISIT TO I.G. FARBENINDUSTRIE WERK/HOECHST HOECHST/MAIN

1. INTRODUCTION.

a. This target was visited by a team with two main purposes in mind, namely medical and organic chemicals. The medical and pharmaceutical phases of the visit and interviews are recorded in a separate report by other members of the team. This report covers only the organic chemical part of the plant's activities.

b. It was found that the plant and offices at Hoechst/Main were intact, only a small amount of damage being caused by bombing. Several people were interviewed and an extensive tour of the plant was made. Because of its enormous size, much of the plant had to be missed, and no attempt was made to search the offices for documents. Since most of the key personnel were present, it was felt that better results would be obtained if these people were asked to supply the information required There has been ample opportunity for all important documents to be removed to a place of hiding, and since no guard had been put on the plant except on one research building in which work on Radar was being conducted, it is likely this was done. There was little of Black List importance found in the investigation although some important Grey List material was apparent. The people interrogated were moderately co-operative, but naturally were not willing to offer any information unless specifically asked to do so.

c. The plant is 1500 x 1000 meters in area and normally employed 12,000 people. 3,000 men had been taken by the Army and 3,000 foreign workers were supplied in replacement. The buildings are all well constructed and spaced 30 meters apart for fire protection.

2. INTERVIEW WITH PROF. LAUTENSCHLÄGER, DIRECTOR.

a. Prof. Lautenschläger is in full charge of all pharmaceutical activities of the company, and, therefore, much of the interrogation was left to the medical men of the team.

b. From a chemical point of view the most important point gleaned from this interview was the manufacture of Fluor-Geserol. Geserol is the trade name used by I.G. for D.D.T. and Fluor-Geserol refers to difluorodiphenyltrichlorethane in which two fluorine atoms take the place of two chlorine atoms in the benzene nuclei.

c. I.G. have preferred to use D.D.T. in emulsion form rather than as a powder and because of its relatively high melting point they claim to have had difficulty in preparing satisfactory emulsions. One attempt to avoid this trouble had been to deliberately make an impure product in which side reaction products were left behind to lower the melting point. It had been found, however, that a still greater lowering of melting point, and a much better product for emulsification could be made if fluorbenzene replaced chlorbenzene in the condensation. Also, it was thought that the resulting product had improved insecticidal properties, particularly against mosquitoes. Fluor-Geserol is also known in the factory as GIX.

d. The hydrofluoric acid was obtained from Leverkusen. The chloral and fluorbenzene were made at Hoechst. The production capacity was 70 tons per quarter.

e. The process for the manufacture of GIX was obtained in a detailed write up, together with the process for manufacturing the intermediates and a flow sheet of equipment layout. This information will be found in the documents filed with MIRS. (See appendix).

3. INTERVIEW WITH DR. KARL WINNACKER.

a. Dr. Winnacker was completely responsible for all chemical production and research except dyestuffs and pharmaceuticals. He outlined the principal chemical activities of the company under the following headings:-

(1) Inorganic
(2) Organic chemicals
(3) Organic chemicals from acetylene
(4) Plastics
(5) Dyestuffs
(6) Textile and water conditioning chemicals, emulsifiers etc.
(7) Tanning materials

b. The inorganic group was left entirely alone since it was realized that the processes were in the main, standard ones. It was, however, found that in the making of sulphuric acid very little native sulphur was used but very large rotary burners for pyrites were installed and operated. The whole plant was closed down for want of fuel but considerable stocks of raw materials were on hand that would allow for two or three months of full production.

c. Under the heading of organic chemicals, a number of items were thrown together, mostly dye intermediates. Also the products resulting from the chlorination of methane (the latter obtained from coal gas by the Linde process followed by fractional distillation). Nothing very novel was observed in this work although the plant was of excellent construction and quite extensive. Of war interest is the production of chloroform; methyl chloride (for methyl cellulose); monochloracetic acid (for acetylating cellulose); chlorobromomethane (used as a fire extinguishing agent to replace carbon tetrachloride), and Frigen (dichlorodifluoromethane or Freon 12).

d. Under the heading of acetylene compounds, a number of interesting chemicals were produced. It was revealed that I.G. had agreements with Wacker whereby they each shared processes, but the processes used at Hoechst were mostly their own modifications. The usual line of acetylene derivatives were produced, e.g., acetic acid, methyl acetate, aldol, crotonic aldehyde, etc., all of which are critical chemicals under a war economy. The acetaldehyde required was received by barge from Knapsack. Two extremely interesting modifications were being used that have only recently become common practice in the U.S. because of cheaper sources of raw materials. These processes involve the reduction of crotonaldehyde. Full reduction with hydrogen, done in the gaseous phase with a copper catalyst carried on pumice at a temperature of 180° - 250°C., gives butanol in good yield. Partial reduction carried out in the liquid phase, at low pressures and 20° - 30°C over a nickel catalyst on pumice, gives butyric aldehyde in good yield. Under the German economy this avoided the use of cereal crops.

Methods for carrying out these processes have been obtained and the original documents should be consulted for further details.

e. The fourth group comprising plastics consisted of a number of interesting developments pertaining to vinyl compounds. 900 - 1000 tons per month of monovinyl acetate were produced which were converted to 300 tons of solid polyvinyl acetate and 600 to 700 tons of polyvinyl acetate in emulsion form. There was capacity for 35 tons of polyvinyl alcohol most of which was claimed to be used for emulsifying polyvinyl acetate. Some 2 - 3 tons were stated to find use for textile sizing and offset printing.

These vinyl products found uses in coating materials for artificial leather, textiles, lacquers etc. The processes are not very different from those used in the U.S. Mixed polymers of vinyl chloride and vinyl esters are produced in this plant, as well as cross polymers of vinyl esters and crotonic acid.

An interesting product made by condensing 1 mole of vinyl fluoride with 1 mole of maleic anhydride, and which is soluble in ammonia, is claimed to be useful for emulsifying other vinyl plastics.

A plasticizer for nitrocellulose and also useful in making plastic emulsions was manufactured at the rate of 180 tons per month under the name of Uresin B. This was manufactured by reacting butanol with urea to form a urethane and then condensing this with formaldehyde.

f. Dyestuffs were touched upon only very lightly since this phase of their work is so extensive. A trip was made through various parts of the dye plants and all were intact and in first-class working order ready for manufacture if power and steam were available. The production of dyes was a primary project in this plant and almost all types of colors, indanthrene, azo, triphenyl methane, etc., as well as photographic sensitizers were manufactured in very considerable quantities.

g. Textile and water conditioning chemicals ran into production well in excess of 1,000 tons per year. A line of products known as Igepons were made from the sodium sulphonates of aliphatic glycols. Igepon A is a straight carbon chain derivative while Igepon T is of the amide type, and similar in properties to the Gardenols and Naccanols of the U.S. The

Igepon T type are extremely good because of their great stability against calcium salts and hard water.

A middle fraction of C_{12} to C_{16} hydrocarbons from the Fischer-Tropsch process was also being sulphonated at low temperature to give sulphonic acid salts, claimed to be of value as detergents for vegetable fibers, but of little value for wool.

h. Tanning material production was being carried out under a list of products referred to as Tanigans. Several grades exist, but a total production of around 6000 tons per year was produced in 1944. They are complex resins formed usually by condensing a formaldehyde-phenol reaction product with a complex naphthalene sulphonic acid. It is believed that these materials are somewhat similar to the Orotans turned out by Rohm and Haas in the U.S.

4. MISCELLANEOUS ACTIVITIES.

a. It was found that the plant was engaged in a large number of miscellaneous activities, some chemical, others more closely physical. Along the chemical line they were actively engaged in making fire fighting compounds. Chlorobromomethane has already been mentioned earlier in this report. Another material sold is Tutagen 43 and claimed to be good for oil fires, which is a mixture of:-

10%	Nekal (or product like it)
4%	Aluminum chloride
35%	NaOH
20%	Sulphite liquors from the paper industry.
31%	Water
100%	

b. Another extremely interesting chemical product developed at Hoechst is for the production of glycerine from cheap sugars by hydrogenation. A plant capable of producing over 1500 tons in 1944 was inspected and the process reviewed. Sugar is dissolved in water, inverted with $\frac{1}{2}$ to 1% oxalic acid and then subjected to hydrogenation at 200°C and 300 atmospheres pressure through a series of tubular reactors. Nickel on pumice is the catalyst used. The reactant mass is filtered, cleared with charcoal, and dried under vacuum. It consists of the following mixture:-

40%	Glycerine
40%	Propylene glycol
20%	Hexahydric alcohol

According to Dr. Winnacker this mixture was being used as recovered, and was not being fractionated for nitration purposes. It was stated by him that the material was used as a substitute for glycerine where the physical properties of the mixture were suitable. There may be reason to doubt the veracity of these statements because such a mixture could be fractionated readily if so desired.

c. It is possible that nitrated glycerine was being made, and also it is possible that glycerine might have been supplied for the manufacture of synthetic fats.

P. J. LEAPER

APPENDIX A.

The following documents were collected while on a visit to this plant, and have been turned over to MIRS for filing:-

1. Entwicklungsarbeiten des I.G.Werkes Hoechst. (Development work of the I.G. Works, Hoechst.)
2. (Geheime Kommandosache). Wehrmachtentwicklungsarbeiten in der Hauptgruppe 2. (Development work for the Armed Forces in the classification No.2. Top Secret.)
3. Fabrikationen des I.G. Werkes Hoechst, 1944. (Manufactured Products of I.G. Works, Hoechst, 1944.)
4. Uebersicht ueber die ungefaehre Zahl an Farbstofftypen der Farbenfabrik I.G. Hoechst. (Survey of the approximate amounts of dyestuff production at I.G. Works, Hoechst.)
5. Mowilith Dispersionen fest Produkte Loesungen. (Mowilith, Dispersions, Solid Material and Solutions.)
6. 13 photographs showing views of I.G. Works, Hoechst.
7. Fernsprech Verzeichnis I.G. Werk - Hoechst. (Telephone Directory, I.G. Works, Hoechst.)
8. Fabrikation der wichtigsten Produkte des Jahres 1944 aus den Gebieten der organischen Chemikalien und Kunstoffe gemaess userer bereits uebergeben Fabrikationsaufstellung vom 4 April, 1945. (Manufacture of principal products for the year 1944, covering organic chemicals and plastics according to the statements given as of 4 April, 1945.)
9. Betriebs vorschriften. (Production methods including several blueprints of flow sheets of a number of chemicals and chemical products manufactured by IG at their Hoechst works.)